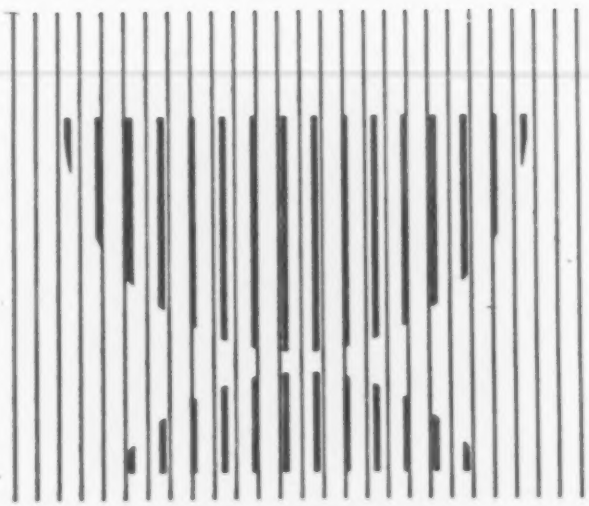
CBO STAFF MEMORANDUM

COSTS OF OPERATION DESERT SHIELD

January 1991



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This Congressional Budget Office (CBO) memorandum provides a range of estimates of added costs associated with Operation Desert Shield, both in the absence of war and in the event of war. The analysis was requested by the Chairman of the Senate Committee on the Budget. The memorandum focuses primarily on budgetary costs. However, as the Chairman suggested in his letter of request, many other factors must be considered in decisions about war and peace in the Persian Gulf--including political and moral factors--that are clearly more important than budgetary costs.

The section estimating costs in the absence of hostilities was prepared by Michael Miller with the assistance of Amy Plapp and Lisa Siegel; Kent Christensen compiled information on allied contributions. The section estimating costs in the event of war was prepared by Michael O'Hanlon under the supervision of Robert Hale and Neil Singer, with important information and comments provided by Michael Berger, Frances M. Lussier, V. Lane Pierrot, Joel Slackman, and William Thomas. Questions regarding estimates of costs in the absence of war should be addressed to Michael Miller (202-226-2840); regarding wartime costs, to Michael O'Hanlon (202-226-2900).

INTRODUCTION AND SUMMARY

The added costs of U.S. military activities in the Persian Gulf are highly uncertain. But Operation Desert Shield could add substantially to defense spending, particularly in the next year or two. These added costs are exempt from the limitations on defense spending contained in the Budget Enforcement Act of 1990. This Staff Memorandum estimates a range of potential added costs, both in the absence of war and in the event of war.

The memorandum is intended as a guide to levels of added defense spending, and so focuses primarily on budgetary costs. Of course, many other factors must be considered in reaching decisions about war or peace in the Persian Gulf--including some political and moral factors that are clearly more important than budgetary costs.

Several conclusions emerge from this Congressional Budget Office (CBO) analysis. First, with or without a war, the costs of Operation Desert Shield are highly uncertain. Second, the added costs could be substantial. For example, if a war started early in calendar year 1991, added costs could range from $17 billion to $35 billion in budget authority in fiscal year 1991, with large additional costs possible in later years for the replacement of lost equipment. The 1991 costs of a war are likely to be at least as large as, and probably significantly larger than, costs in the absence of hostilities. If all losses of major weapons and munitions were replaced, the total cost of a war could range between $28 billion and $86 billion.

PROBLEMS IN ESTIMATING COSTS

Estimating the costs associated with Operation Desert Shield presents conceptual and definitional problems. The cost estimates, particularly those associated with the cost of war, are also subject to great uncertainty.

Total Costs Versus Incremental Costs

The major estimating problem raised by Operation Desert Shield involves separating total from incremental costs. The estimates in this memorandum are intended to reflect the additional or incremental costs associated with Operation Desert Shield, not total costs. For many categories of expenses, incremental costs could be a small fraction of total costs. Military personnel costs are a good example. The total costs of Operation Desert Shield include the pay and allowances for all military personnel involved in the operation, including those already on active duty and those part-time reserves who are called to active duty. The incremental costs include only the significantly

smaller sums for the pay of those reserves called to active duty, family separation allowances, hostile fire pay, and some moving expenses.

Although incremental costs can be defined easily, they are hard to estimate accurately because of the difficulty of knowing what would have happened in the absence of Operation Desert Shield. For example, what portion of the costs of airlift supplied by the Military Airlift Command would have been incurred anyway? No doubt some of the airlift funds attributed to Operation Desert Shield would have been spent airlifting supplies to troops now in the Persian Gulf even if there was no such operation and those troops were stationed in Europe, Korea, or the United States.

Offsetting at least some of these incremental costs are savings from activities or expenditures that the Department of Defense (DoD) will not have to undertake as the result of Operation Desert Shield. For example, units now deployed in the Persian Gulf would have incurred some training costs in the absence of Operation Desert Shield. Similarly, some of the spare parts and consumable supplies being purchased in connection with Operation Desert Shield will obviate the need for future purchases. Neither the department nor CBO has estimated the value of such offsets, but the Congress may want to take account of them in considering any DoD request for supplemental appropriations.

In this memorandum, CBO has made every effort to exclude from the incremental costs of Operation Desert Shield those expenses that would have been incurred anyway. However, CBO's estimates, and past estimates made by DoD, probably do not meet this test in some instances.

Treatment of Fuel Costs

Added fuel costs illustrate the definitional problems that are encountered in estimating the costs of Operation Desert Shield. In its August estimate of the costs of deploying 200,000 troops for Operation Desert Shield, the Department of Defense (DoD) included the added expenses incurred by military units worldwide as a result of higher oil prices. The Congress may decide to include added fuel costs as part of a 1991 supplemental appropriation. But the costs associated with higher fuel prices, while related to the Iraqi invasion of Kuwait, are not necessarily attributable to Operation Desert Shield, except for the small portion of those costs that pay for fuel actually used in the operation.

Uncertainty About the Cost Estimates

There is also substantial uncertainty about the cost estimates in this memorandum. DoD has not yet released estimates of the added costs of the currently planned deployment in the absence of war. In other circumstances, CBO could fall back on previous military deployments as a guide to costs, but experience is not much help with Operation Desert Shield. Stationing troops in Saudi Arabia is not the same as stationing them in Europe, Korea, or the United States. Geographic considerations, such as the extreme heat and sandy conditions, put special stress on the logistical system, which makes experience less useful as a guide to costs. The threat of a war may also influence operating tempos and maintenance policies, which could affect costs in ways that would not be captured by relying on experience.

The uncertainty is magnified many times when estimating the cost of a war. The duration and intensity of a war would influence costs significantly, but no one can be certain about how long or how intense a Persian Gulf war would be. Nor is it clear how characteristics such as a war's duration and intensity should be translated into added costs. The Vietnam War--the last major war fought by the United States--provides useful information, but it is an imperfect guide for a number of reasons. For example, the Vietnam War involved few tanks, but a Persian Gulf war might involve extensive tank combat. The Korean War involved heavy use of tanks, but even less information is available about the added costs of that war than about costs during the Vietnam conflict. Models of peacetime operating costs, which can be used to estimate the added expenditures associated with the higher operating tempos that would occur during a war, may miss some of the extraordinary costs of war, including loss and wastage of supplies.

These important uncertainties suggest that the cost estimates in this memorandum, and the estimates made by the Defense Department, should be taken only as rough guides to the actual costs of Operation Desert Shield. This caveat applies most strongly to estimates of the costs of a war.

ADDED COSTS IN THE ABSENCE OF A WAR

In the absence of war, the added costs of Operation Desert Shield in 1991 would depend on whether the currently planned deployment continues throughout 1991 or ends earlier because of a negotiated settlement.

Currently Planned Deployment Continues

Last November, CBO developed a rough estimate of the added costs of Operation Desert Shield. This estimate assumed that the deployment continued throughout 1991 and involved roughly 400,000 troops but no hostilities. The estimate implicitly adopted many of the assumptions included in DoD's earlier estimate of the cost of deploying about 200,000 troops.

The CBO November estimate was $12 billion of budget authority. Since that time, however, information has become available that suggests the $12 billion estimate was too low. Some of this information regards the costs of activating reserve personnel. The November estimate assumed that about 60,000 reservists would be called to active duty. Instead, 150,000 may be activated, thereby adding $3 billion to CBO's November estimate and bringing the estimate to $15 billion (see Table 1).

CBO's estimate could rise further in coming weeks if the Defense Department submits its estimate of the costs of Operation Desert Shield. Press reports and testimony by the General Accounting Office suggest that the DoD cost estimate could total roughly $30 billion. Judging from DoD's earlier estimate of the cost of deploying 200,000 troops, DoD's revised estimate will probably include larger amounts of funding than are included in CBO's estimate for rotation of troops between the Persian Gulf and the United States and for military construction. It is possible that DoD's higher estimate of funding will be supported by new information that could cause CBO to increase its estimate.

To illustrate these possible increases, CBO developed an estimate using alternate costing assumptions, many of which are consistent with assumptions made by DoD in its earlier estimate of the cost of deploying 200,000 troops. The alternate assumptions suggest that continued deployment could add as much as $25 billion to budget authority in 1991. Up to $7 billion more could be spent on transportation costs, primarily for rotating troops, than is assumed to be spent under CBO's current assumptions. The alternate assumptions also include additional expenditures of about $2 billion for military construction and roughly $1 billion to pay the costs of postponing the reduction in active-duty military personnel planned for 1991.

If past estimates are a guide, CBO's estimate of the cost of Operation Desert Shield, even under the alternate assumptions, may still be lower than the estimate that will eventually be submitted by DoD, primarily because of differences about the costs of deploying the troops and the costs of military construction. In its August estimates of the cost of deploying and sustaining 200,000 troops, DoD anticipated that airlift, sealift, and other deployment cost

TABLE 1. ADDED COSTS OF OPERATION DESERT SHIELD
(In constant 1991 dollars of budget authority)

Assumptions About Events in 1991	Added Costs	
	In 1991	Beyond 1991
Costs in the Absence of Hostilities		
Current Deployment Continues Throughout 1991	$15 billion to $25 billion	Could remain at or near 1991 level if deployment continues
Negotiated Settlement about March 1[a]	$14 billion to $18 billion	Probably a few billion dollars or less
Costs in the Event of War		
Hostilities Begin in the First Few Months of 1991	$17 billion to $35 billion	About $11 billion to $51 billion if all lost equipment is replaced

SOURCE: Congressional Budget Office.

a. This estimate assumes that U.S. troop levels fall from about 400,000 on March 1 to about 100,000 by the end of fiscal year 1991.

would be about four times higher in 1991 than in 1990. Using cost-factor handbooks provided by the Army and Air Force, CBO was convinced that the deployment could be accomplished in fiscal year 1990 within the DoD estimate of costs for that year. The Defense Department did not explain at that time why deployment costs for 1991 would increase fourfold even though the deployment of 200,000 troops was to be nearly complete by the end of 1990.

In part, the uncertainty about deployment costs reflects uncertainty about the Defense Department's rotation policies. DoD could decide to bring some troops and their equipment home from Saudi Arabia and replace them with new troops and new equipment. Such a policy would minimize mismatches between troops and equipment as the rotation progressed, but moving both troops and equipment would be costly and might require funding at or near the level requested by DoD. Alternatively, DoD could hold down costs by rotating only the personnel, either moving entire units at one time or moving personnel without regard to units.

Costs of military construction accounted for the other main difference between past estimates made by CBO and DoD. Last August, DoD estimated that military construction in Saudi Arabia would require $1.8 billion in added funding. DoD has not specified what kind of facilities would be built, how many would be built, and how much each facility would cost. CBO's future estimates of construction costs may be lower than DoD's estimates, depending on the types of information about construction costs that accompany DoD's estimates.

Negotiated Settlement Achieved

At the request of the Chairman of the Senate Budget Committee, CBO has also estimated the 1991 costs of Operation Desert Shield assuming a negotiated settlement of the Persian Gulf crisis. In accordance with the Chairman's letter, a negotiated settlement is assumed to take place about March 1 and to result in a reduction of U.S. forces stationed in the Persian Gulf from about 400,000 on March 1 to about 100,000 by the end of fiscal year 1991. These specific dates and numbers should not be construed as a forecast of events but rather as assumptions chosen to illustrate possible effects on costs.

The added costs assuming a negotiated settlement would be lower than those associated with continuing the currently planned deployment throughout 1991. The reduction in costs, however, could be modest. Under CBO's current assumptions, budget authority in 1991 might fall from $15 billion to $14 billion (see Table 1). The reduction would be modest in size if the additional 1991 costs to transport troops back home after the settlement offset the savings from having fewer troops in the Gulf.

The reduction in costs might be more substantial if the negotiated settlement permits DoD to avoid some of the costs that are included under the alternate costing assumptions. Under these assumptions, added costs might fall from about $25 billion for continued deployment to about $18

billion for a negotiated settlement. The estimate of $18 billion assumes that a negotiated settlement would obviate the need for many of the expenditures for troop rotation and military construction included in the estimate of $25 billion. A negotiated settlement should also permit some of the planned reduction of active-duty personnel to be carried out.

Although CBO has not made estimates of added costs in 1992, they are also likely to be substantially lower if there is a negotiated settlement in 1991 rather than a continuation of the currently planned deployment. The negotiated settlement assumed in this memorandum would leave only about 100,000 U.S. troops in the Persian Gulf at the beginning of fiscal year 1992. If the currently planned deployment continues, 1992 will begin with 400,000 U.S. troops serving in the Gulf. Therefore, the added costs in 1992 of a continued deployment could be substantial, whereas the added costs in 1992 of a negotiated settlement should be modest, probably no more than a few billion dollars.

By definition, a negotiated settlement also means that there would be no hostilities. Thus, a settlement would avoid the added costs of war, which could be substantial.

ADDED COSTS IN THE EVENT OF A WAR

The Defense Department has not released estimates of added costs in the event of a war in the Persian Gulf. No one can estimate the cost of war with confidence because costs would depend critically on how such a war was fought. To illustrate potential costs, CBO has developed a range of estimates based on forecasts made by various military analysts of the duration and intensity of a war.

Added Costs Incurred in Fiscal Year 1991

Based on these forecasts, and assuming that a war begins in early calendar year 1991, CBO estimates that requirements for the supplemental funding in fiscal year 1991 could range between $17 billion and $35 billion of budget authority (see Table 2). Estimates of added costs reflect increased expenses for U.S. military personnel, some of the added wartime operation and maintenance costs for U.S. equipment, a small part of the costs to replace munitions expended in the war, portions of the cost of medical care for U.S. casualties, and portions of basic support costs for U.S. troops (including costs incurred before and after hostilities). The added costs represent sums

required instead of, not in addition to, requests for supplemental funding in the absence of a war.

The 1991 costs of a war are likely to be at least as large, and probably significantly larger, than costs in the absence of hostilities. The higher estimate of $35 billion in added 1991 costs would substantially exceed costs in the absence of hostilities. The lower estimate of $17 billion in 1991 would exceed the lower estimate of either continuation of the currently planned deployment or a negotiated settlement of the type assumed in this memorandum (see Table 1).

The wide range of estimated costs of war in 1991--$17 billion to $35 billion in 1991--reflects varying assumptions about the duration of the war, casualties (dead and wounded), and equipment losses. CBO based its estimates on publicly available forecasts made by a number of military analysts including former military officers, a military historian, and two political scientists. Although DoD has not publicly released such a forecast, press reports purporting to represent the Pentagon view were also considered. The appendix to this memorandum documents these forecasts as well as the methods CBO used to translate assumptions about the characteristics of a war into costs.

All of CBO's estimates of costs assume that the United States fights the war with military forces now planned for deployment to the Persian Gulf. The lower cost estimate makes optimistic assumptions about a shorter war--that is, assumptions that would result in lower costs for such a war. These assumptions suggest that a shorter war would last less than a month, and would primarily involve air combat coupled with some limited ground attacks. U.S. casualties might amount to about 3,000 dead and wounded. [1] The United States could lose 200 of its tanks (about 10 percent of those that press reports suggest will be in the Persian Gulf when the currently planned buildup is complete) and 100 of its fixed-wing aircraft (about 3 percent).

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1. The assumption of 3,000 casualties is the same as the lower end of the casualty range deemed most likely by the Chairman of the House Committee on Armed Services.

TABLE 2. ADDED COSTS OF WAR (In billions of constant 1991 dollars of budget authority)

Cost Category	Incurred Mostly in 1991[a]	Incurred Mostly Beyond 1991 If at All[a]	Total
Lower Estimate			
Military Personnel	4	1	5
Operation and Maintenance	1	b	1
Replacement of Major Weapons	0	5	5
Replacement of Munitions	1	4	5
Medical Costs	b	b	b
Basic Support Costs	11	1	12
Total	17	11	28
Higher Estimate			
Military Personnel	6	2	8
Operation and Maintenance	12	3	15
Replacement of Major Weapons	0	28	28
Replacement of Munitions	4	13	17
Medical Costs	2	2	4
Basic Support Costs	11	3	14
Total	35	51	86

SOURCE: Congressional Budget Office.

NOTE: The methods used in making estimates are discussed in the appendix.

a. These costs might be incurred only in part, or not at all, if the United States decides not to replace all the major weapons and munitions lost in the war.

b. Less than $0.5 billion.

CBO also based a higher estimate of costs on pessimistic assumptions about a longer war--that is, assumptions that lead to higher estimates of costs. These assumptions suggest that a longer war would involve both air combat and repeated ground attacks over a period of one to six months. Casualties could reach 45,000. U.S. equipment losses could total 900 tanks and 600 fixed-wing aircraft.

By choosing assumptions that lead to lower costs for a shorter war, and higher costs for a longer war, CBO attempted to provide information about the range of potential costs without engaging in extensive speculation about the exact nature of a war. There are, however, alternative views among military analysts about the nature of both a shorter and a longer war. Some of these views could lead to estimates of the added costs for a shorter war that are greater than $17 billion for 1991; some views about a longer war could lead to estimates of added costs that are less than $35 billion.

There is also uncertainty about how much of the costs of a war would be incurred in 1991 and how much in later years. The estimates of 1991 costs in Table 2 are based on various assumptions, which are discussed in the appendix, that may not all match actual events. For example, the estimates in Table 2 assume that DoD would not request added budget authority in 1991 to replace equipment lost in combat because of the time required to assess equipment inventories and make budgetary proposals. If DoD did request budget authority in 1991 to replace lost equipment, then 1991 costs could be higher than those shown in Table 2.

Added Costs Beyond 1991

Beyond 1991, added budget authority associated with a war could range from $11 billion for a shorter war to $51 billion for a longer war (see Table 2). Costs would probably be incurred for supplies and munitions consumed during the war in 1991 but not replenished until after 1991. There would also be some expenses for medical care (such as payments for disability retirement) that would continue for many years. Also, postponing the planned reductions in military personnel in 1991 could lead to some added costs beyond 1991.

Other categories of post-1991 costs included in this range of $11 billion to $51 billion might not be incurred at all or only in part. The United States would lose major weapons in a battle, primarily tanks, armored personnel carriers, helicopters, and fixed-wing aircraft. DoD, however, is planning a major reduction in its military forces and could well decide not to replace some or all of these major weapons. Similarly, some munitions expended in

battle might not be replaced because of the lower requirements for munitions resulting from the force reductions.

Total Costs

Adding together the costs in 1991 and beyond suggests that total costs of a war could range between $28 billion and $86 billion (see Table 2). This estimate assumes that the United States elects to replace all the major weapons and munitions lost in the war.

Some Potential Costs Not Included in Cost Estimates

A war could lead to substantial costs in the years beyond 1991 that are not included in CBO's estimates either because their magnitude could not be assessed even roughly or because the costs depend on highly uncertain decisions about future policy. The United States may leave troops or equipment in the Persian Gulf region, which could require construction of military bases or the purchase of ships on which to preposition equipment. Operation Desert Shield, perhaps coupled with other world events, could lead to a decision to postpone or change plans for large cuts in the overall size of the U.S. military. These cuts have been widely anticipated because of the reduced military threat in Europe. If cuts are delayed or reduced, the defense budget in the mid-1990s might be higher than it would have been in the absence of Operation Desert Shield. A war might also make people more reluctant to volunteer for military service, pushing up recruiting costs.

After the war, the United States might increase funds sent to foreign countries for humanitarian assistance and reconstruction. Indeed, the United States forgave repayment of about $7 billion in loans to Egypt as part of a package of aid in connection with Operation Desert Shield. If history is a guide, future aid could go to allies or former adversaries and could be substantial.

CONTRIBUTIONS OF ALLIES

While the amount is highly uncertain, the United States clearly could incur substantial added costs in 1991 in connection with Operation Desert Shield whether or not there is a war. Some of these added costs will be paid by U.S. allies. Allied contributions to date have been substantial. As of January 2,

TABLE 3. CONTRIBUTION OF ALLIES TO OPERATION DESERT SHIELD (In millions of U.S. dollars)

	Cash Contributions[a]	In-Kind Contributions[b]	Total
Kuwait	2,500	6	2,506
Saudi Arabia	760	854	1,614
Japan	428	206	634
Germany	272	66	338
United Arab Emirates	550	111	661
Korea	50	11	61
Other	0	3	3
Total	4,560	1,257	5,817

SOURCE: Congressional Budget Office using data from the Department of Defense.

a. Includes all contributions received as of January 2, 1991.
b. Includes the value of fuel and other supplies received by U.S. forces, as of December 31, 1990.

1991, the allies had contributed about $4.6 billion in cash (see Table 3). Another $1.3 billion in in-kind assistance was received as of December 31, 1990. Kuwait had made the largest contribution, followed by Saudi Arabia. These contributions have probably offset much of the added U.S. costs incurred to date.

What is not clear, however, is the portion of future costs that the allies might bear. Several months ago, DoD stated that the allies would pay about half of the added costs of $15 billion expected in connection with the earlier plan to deploy about 200,000 troops to the Persian Gulf. But DoD has not yet stated how much of the costs of the larger deployment now planned would be paid by the allies. Nor has DoD said what the allies might pay in the event of a war.

Allied contributions will have to rise substantially if they are to offset a large fraction of likely U.S. costs in 1991. The roughly $6 billion contributed through January 2 represents only a small fraction--about one-sixth--of CBO's

higher estimate of the 1991 costs associated with a war. The $6 billion would represent a larger fraction of likely costs in the absence of hostilities, but would still amount to less than half of those costs.

CONCLUSION

Regardless of what happens in the Persian Gulf, the United States seems likely to face some substantial added costs in 1991. These costs would be measured in billions if the crisis ends quickly and allied contributions are substantial. Added costs could be much higher--many tens of billions--if the United States finances most of the cost of a war that lasts many months.

These costs are important and must be considered in debates over U.S. spending choices and fiscal policies. Nevertheless, considerations other than costs--including threats to U.S. and world security and the potential for loss of human life--must figure most prominently in decisions about war and peace in the Persian Gulf.

APPENDIX. METHODS USED TO ESTIMATE ADDED COSTS OF A WAR

The Congressional Budget Office based its assessment of the added costs of a war on forecasts by various experts of the characteristics of a war. This appendix discusses these forecasts and the methods used to translate wartime characteristics into costs.

FORECASTS OF THE CHARACTERISTICS OF A WAR

The estimates of wartime characteristics shown in Table A-1 reflect the forecasts made by military analysts working independently and at research institutions and universities, as well as forecasts contained in press reports purporting to represent Pentagon estimates. These forecasts are based on widely differing assumptions about the nature of a Persian Gulf war. All of the estimates assume that the United States would have to attack on the ground as well as in the air, but they differed about the duration of the ground attacks (from brief to protracted) and on their scope.[1] Most analysts assumed that ground attacks would be confined to Kuwait and nearby portions of Iraq. The analysts at the Center for Defense Information, however, assumed that the allies would wage a land campaign against Baghdad.

TRANSLATING CHARACTERISTICS INTO COSTS

CBO estimated all costs in 1991 dollars of budget authority using various estimating methods, depending on the category of costs. The details for each category are shown in Table A-2.

Military personnel costs were estimated based on numbers of personnel and average costs per person. Estimates assumed that some of the personnel reductions in the active-duty force planned for 1991 would be postponed. The lower estimate assumed postponement of half the reduction, which required funding for about 20,000 additional man-years in 1991; the higher estimate assumed postponement of all of the reductions, requiring funding for 40,000 additional man-years in 1991. The lower estimate assumed a buildup to about 150,000 reserves by the middle of fiscal year 1991, followed by a reduction to

1. Trevor Dupuy argued that the allies could perhaps prevail against Iraq relying only on an air attack. The assumption of an air-only war was, however, in only one of twelve scenarios for war considered by Dupuy. None of the other military analysts assumed an air-only war. Therefore, all of CBO's estimates assume some ground combat.

TABLE A-1. PUBLIC ESTIMATES OF CHARACTERISTICS OF AIR-GROUND WAR

Source	Length	Casualties (Thousands)	Tanks Lost	Tactical Aircraft Lost	Helicopters Lost
Epstein [a]	Weeks of combat	3 to 16	200 to 900	300 to 600	75 to 250
Posen [b]	Weeks	4 to 11	n.a.	n.a.	n.a.
Dupuy [c]	10 to 40 days	7 to 17	200 to 600	190 to 315	50 to 250
Press Reports on DoD/Intelligence Projections [d]	Months	10 to 30	n.a.	n.a.	n.a.
Other Press Reports [e]	n.a.	Up to 16	200	100 to 300	n.a.
Center for Defense Information [f]	Months	40 to 45	n.a.	n.a.	n.a.

SOURCE: Congressional Budget Office based on forecasts cited in notes a through f.

NOTE: All figures apply to U.S. forces only; n.a. = not available.

a. Information from Joshua M. Epstein, Brookings Institution, "War with Iraq: What Price Victory?" Briefing to the Office of the Joint Chiefs of Staff, Washington, D.C., December 19, 1990. Epstein may revise his numbers somewhat in the future. CBO estimated equipment losses by assuming that 75 percent of the total attrition derived by Epstein's calculations would result in the permanent loss of equipment. The other attrition, not reflected in the above numbers, would result from wear and tear during wartime that would render some equipment unusable for the duration of hostilities and that would require extensive repair--but not new procurement--after hostilities were completed.

b. Barry R. Posen, "Political Objectives and Military Options in the Persian Gulf," Defense and Arms Control Studies Working Paper, Massachusetts Institute of Technology, Cambridge, Mass. (November 1990), pp. 24-25.

c. Trevor N. Dupuy, Colonel, U.S. Army, Retired, Attrition: Forecasting Battle Casualties and Equipment Losses in Modern War (Fairfax, Va.: Hero Books, December 1990), pp. 94-103, 128-132; and If War Comes. How to Defeat Saddam Hussein (Fairfax, Va.: Hero Books, 1991), page proofs, p. 104. CBO estimated tank and helicopter losses by extrapolating from Dupuy's historical data. In the latter book, and in Congressional testimony, Dupuy also considers the possibility of an air campaign that produces victory for the coalition with fewer than 1,000 U.S. casualties. In keeping with its focus on air-ground scenarios, however, CBO did not investigate this case further.

d. Rick Atkinson and George C. Wilson, "Land War: Centerpiece of Strategy," Washington Post, December 8, 1990, p. A1; Patrick E. Tyler, "Iraq's Aim: High Toll for G.I.'s," New York Times, November 27, 1990, p. 16; Bruce W. Nelan, "Ready for Action," Time, November 12, 1990, p. 26.

e. George J. Church, "If War Begins," Time, December 10, 1990, p. 28.

f. Center for Defense Information, "U.S. Invasion of Iraq: Appraising the Options," The Defense Monitor, vol. 19, no. 8 (Washington, D.C., 1990).

TABLE A-2. DETAILS OF CBO ESTIMATES OF COSTS OF WAR
(Costs in billions of constant 1991 dollars of budget authority)

Case	Assumptions	Total Added Cost
	Added Military Personnel Costs	
Lower	Build to 150,000 Reserves, Reduce to 30,000 by End of Fiscal Year 1991	3.1
	Postpone Half of 1991 Personnel Cuts (40,000 People)	1.4
	400,000 Receive Hostile Fire Pay for 3/4 Fiscal Year, $110/Month	0.4
	Total	4.9
Higher	Build to 150,000 Reserves and Hold That Level Throughout Fiscal Year 1991	4.8
	Postpone All 1991 Personnel Cuts (80,000 People)	2.8
	400,000 Receive Hostile Fire Pay for Entire Fiscal Year	0.5
	Total	8.1
	Added Operation and Maintenance Costs	
Lower	Weeks of Intensive Combat, 3,000 U.S. Casualties	1.0
Higher	Months of Variable Combat, 45,000 U.S. Casualties	15.0
	Replacement Costs of Major Weapons	
Lower	100 Tactical Aircraft at $25 Million Each (F-15/F-16 Mix)	2.5
	Two-thirds of a Division (200 Tanks) at $3.0 Billion per Division (Heavy M1 Division)	2.0
	Total	4.5
Higher	600 Aircraft at $25 Million Each	15.0
	3 Divisions (900 Tanks) at $3.0 Billion Each	9.0
	5 Ships at $0.75 Billion Each	3.8
	Total	27.8
	Replacement Costs of Missiles and Ammunition	
Lower	Aircraft Attack Ground Targets for 15 Days at 1 Sortie/Day, Using 15,000 Missiles at $100,000 Each	1.5
	Army and Marine Corps Ground Forces Fight for 15 Days at Half the Intensity Assumed for Europe	3.0
	Air Force and Navy Aircraft Use 2 Missiles per Iraqi Aircraft, Against 200 Aircraft	0.1
	Navy Shoots at About 250 Targets, 2 Munitions Each	0.4
	Total	5.0

(Continued)

TABLE A-2. Continued

	Replacement Costs of Missiles and Ammunition (Continued)	
Higher	Aircraft Attack at Variable Rates Over Long Period, Using 30,000 Missiles	3.0
	Army and Marine Corps Fight at Full Intensity for 30 Days, or Lower Intensity Over Longer Period	12.0
	Air Force and Navy Use 5 Missiles per Iraqi Aircraft, Against 500 Aircraft	0.8
	Navy Shoots at 375 Targets, 4 Munitions Each	1.2
	Total	17.0
	Added Costs of Medical Care	
Lower	3,000 Casualties (600 Killed, 2,400 Wounded), for Immediate Care	0.1
	3,000 Casualties, for Care and Compensation Beyond Fiscal Year 1991	0.1
	Total	0.2
Higher	45,000 Casualties (7,800 Killed, 37,200 Wounded), for Immediate Care	2.2
	45,000 Casualties, for Care and Compensation Beyond Fiscal Year 1991	1.6
	Total	3.8
	Basic Support Costs	
Lower	Costs of Negotiated Settlement (Less Personnel Costs Included Elsewhere)	12.0
Higher	Lower Estimate Plus Net Cost of Maintaining 400,000 Troops Throughout 1991	14.0

SOURCE: Congressional Budget Office.

NOTE: Details may not add to totals because of rounding.

about 30,000 reserves by year's end. The higher estimate assumed the same buildup but no reduction. The estimates assumed that 400,000 U.S. military personnel would draw hostile fire pay either for three-quarters of the fiscal year (lower estimate) or for the entire fiscal year (higher estimate).

Several methods were used in estimating wartime operation and maintenance (O&M) costs. The primary method was based on the U.S. experience in Vietnam. CBO used DoD estimates of the added O&M costs during the Vietnam War, adjusted to 1991 dollars but reduced to eliminate the added O&M costs associated with the larger number of personnel serving in the military during the Vietnam War.[2] The resulting figure was divided by the number of casualties during the Vietnam War, which provided an adjustment for the duration and intensity of the conflict. The ratio of cost to casualties was adjusted upward in real terms by 3 percent a year through fiscal year 1991 to reflect higher operating costs associated with today's more complex equipment. (The 3 percent figure is based on the approximate growth in O&M per active-duty person experienced between the 1960s and 1990.) The resulting annual factors were averaged for each year of the Vietnam War. The resulting average factor of about $350,000 for each casualty was used in estimating O&M costs under this method.

The results using this method are broadly consistent with estimates using other approaches. For example, estimates seem roughly consistent with costs incurred during the Korean War. Indeed, although available data regarding costs of the Korean War are more limited than data for Vietnam, they suggest that the cost per casualty may have been somewhat higher during the Korean War--perhaps one-quarter to one-half higher--than costs experienced during the Vietnam War. Another method for estimating added wartime operating costs--the use of models that estimate the costs associated with increases in the tempo of operations that would occur during a war--was also employed as a check. CBO had detailed models available only for the Air Force and had to extrapolate to estimate costs for ground forces. Using this method, CBO estimated that doubling or even tripling the normal peacetime tempo of operations in theater would yield added operations cost ranging between $1

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2. In estimating the added costs of the Vietnam war, DoD apparently included the extra O&M expenses for all personnel added to the military after 1964. Thus, some of the added O&M costs for Vietnam resulted not from the higher intensity of combat operations, but from the costs of having more personnel employed in the military. Because the United States apparently would fight a Persian Gulf war without adding new military personnel, CBO subtracted the added Vietnam O&M costs associated with a larger military before using the numbers to assess the costs of a Persian Gulf war.

billion and $3 billion for each month of intensive combat. These results seem broadly consistent with the results obtained using data from the Vietnam War.

Costs to replace equipment were derived from military analysts' estimates of equipment losses. Tank losses were translated into armored division-equivalents by dividing by about 300 tanks. For each division-equivalent that was lost, CBO assumed replacement costs of $3 billion. This figure is intended to capture the costs of replacing not only tanks but also helicopters and associated equipment that might be lost during ground combat (but not the costs of munitions and spare parts, which are included in other cost categories). Each fixed-wing tactical aircraft that was lost was assumed to cost $25 million--roughly the cost of replacement with the mix of today's versions of the A-10, F-16, F-15, F/A-18, and other aircraft that are in the Persian Gulf. For the higher cost estimate only, CBO assumed the loss of five ships, each costing an average of $750 million to replace. Although none of the military analysts addressed ship losses, such losses seem possible, particularly if the war featured a major amphibious assault.

Replacement costs for munitions (missiles and ammunition) could not be estimated directly from the experts' forecasts because none of them explicitly addressed munitions use. CBO's estimate assumed heavy use of munitions, consistent with the assumption that a Persian Gulf war would be intense. For ground weapons, CBO assumed munitions were either consumed for 15 days at half the daily rate of usage for a major European war (in the lower cost estimate) or for the equivalent of 30 to 60 days at daily usage rates equal to between half the European rate and the full European rate (in the higher estimate). Air-to-ground usage was assumed to be equivalent to 15,000 missiles at the average cost of a Maverick missile (in the lower estimate) or 30,000 such missiles (in the higher estimate). Attacking aircraft were assumed to use 400 air-to-air missiles--assumed to cost about $0.3 million each--in the lower estimate (based on 2 missiles for each of 200 Iraqi aircraft) and 2,500 such missiles in the higher estimate (based on 5 missiles for each of 500 Iraqi aircraft). Finally, the Navy was assumed to shoot between 500 ship-to-surface missiles (lower estimate) and 1,500 such missiles (higher estimate).

Added costs of medical care would include costs for long-term treatment of casualties in U.S. hospitals, costs for the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) brought about by heavy use of military hospitals by injured military personnel, and costs of disability retirement (which would affect the budget of the Department of Veterans Affairs). Cost estimates for medical care were based on peacetime experience as well as experience in the Vietnam and Korean wars.

Finally, basic support costs include operation and maintenance costs for U.S. troops in the absence of hostilities (these costs are included because the method used to estimate wartime operating costs measures only the added costs of maintaining a wartime tempo) as well as costs that would be incurred before and after a war. For the lower estimate, these basic support costs are assumed to equal the costs of a negotiated settlement less reserve costs that were included in a preceding cost category. Thus, basic support costs in the lower estimate include costs to move an additional 200,000 troops to the Persian Gulf and to move some troops home. The higher estimate of basic support costs also includes funds to move troops home (though these costs would probably be incurred in years beyond 1991) plus operation and maintenance costs to maintain all 400,000 troops in the Persian Gulf throughout 1991.

Estimating 1991 Budget Authority

Assumptions about what portion of total added costs would result in increased 1991 budget authority vary by cost category. For some categories, the allocation to 1991 or the years beyond seems clear. Most added costs for military personnel, and for basic support, are assumed to result in increases in 1991 budget authority. All costs of disability retirement are also assumed to be incurred beyond 1991.

For other cost categories, CBO made assumptions that seem reasonable but, as the text notes, are uncertain. Roughly three-quarters of the total costs for operation and maintenance and for medical care (excluding costs of disability retirement) are assumed to be authorized in 1991. If, as is assumed, the war started in early 1991, DoD would probably place orders for replacement supplies reasonably quickly. But only one-quarter of the costs for replacement of munitions are assumed to be authorized in 1991 because of the time that would probably be required to assess inventories and make decisions about how many munitions are to be bought. None of the extra budget authority for weapons is assumed to be incurred in 1991 because time will probably be needed to make decisions about what weapons (if any) to replace.